Perspectives on accelerating the adoption of advanced technologies and energy savings –

Influence and Future Aspects of Clean Diesel Power

DIESEL TECHNOLOGY FORUM

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What *one* clean diesel truck is doing right now . . .

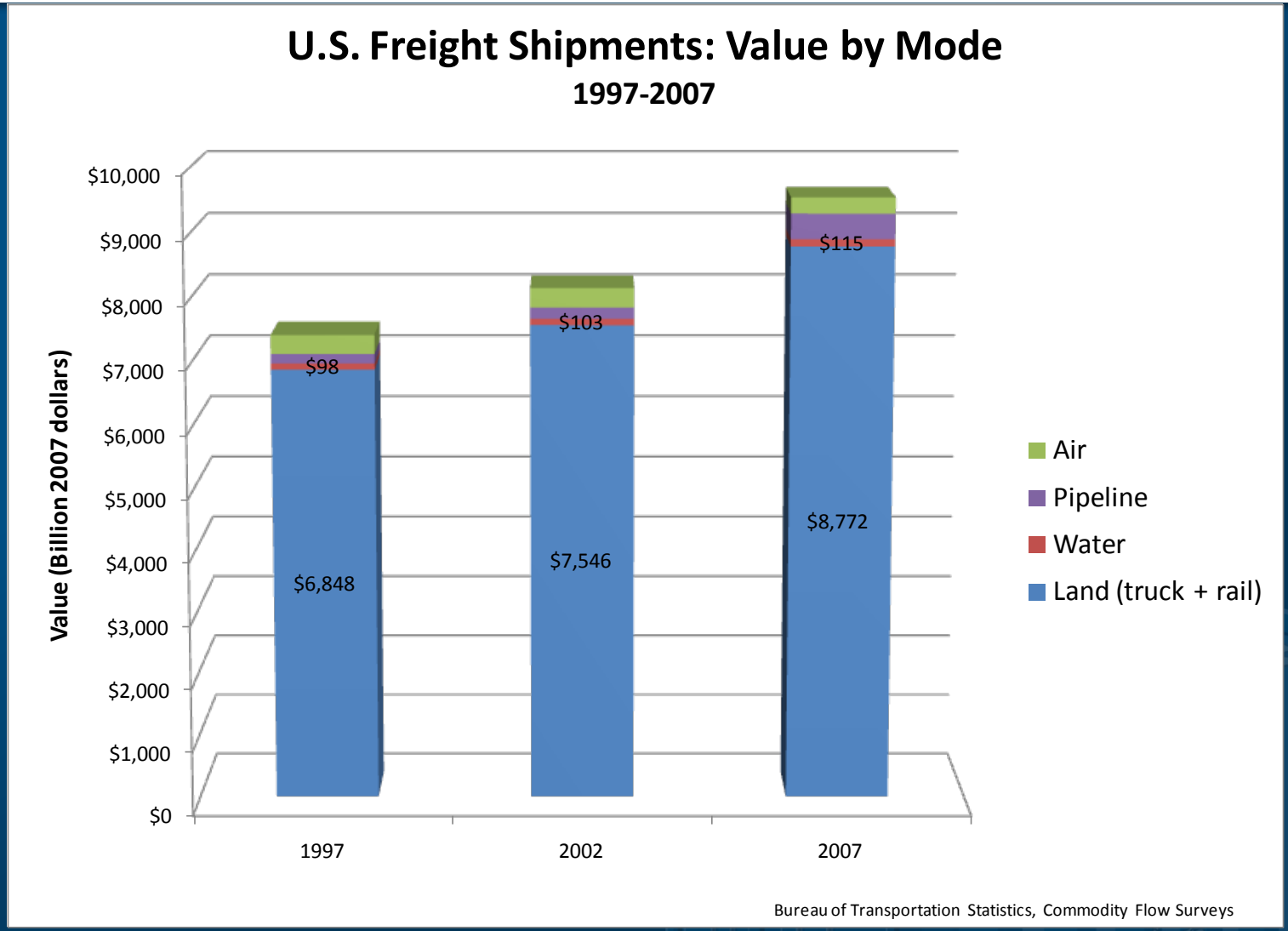
http://www.capitolchristmastree2011.org

December 6, 5pm lighting

LET'S TALK ABOUT

- The role of diesel power in goods movement– past present and future
- Making Change – Accelerating Adoption of new technologies
  - Investing in new technology

83% OF FREIGHT VALUE SHIPPED USING DIESEL



Bureau of Transportation Statistics, Commodity Flow Surveys

So, opportunity for efficiency improvements is significant: *small changes = big results*

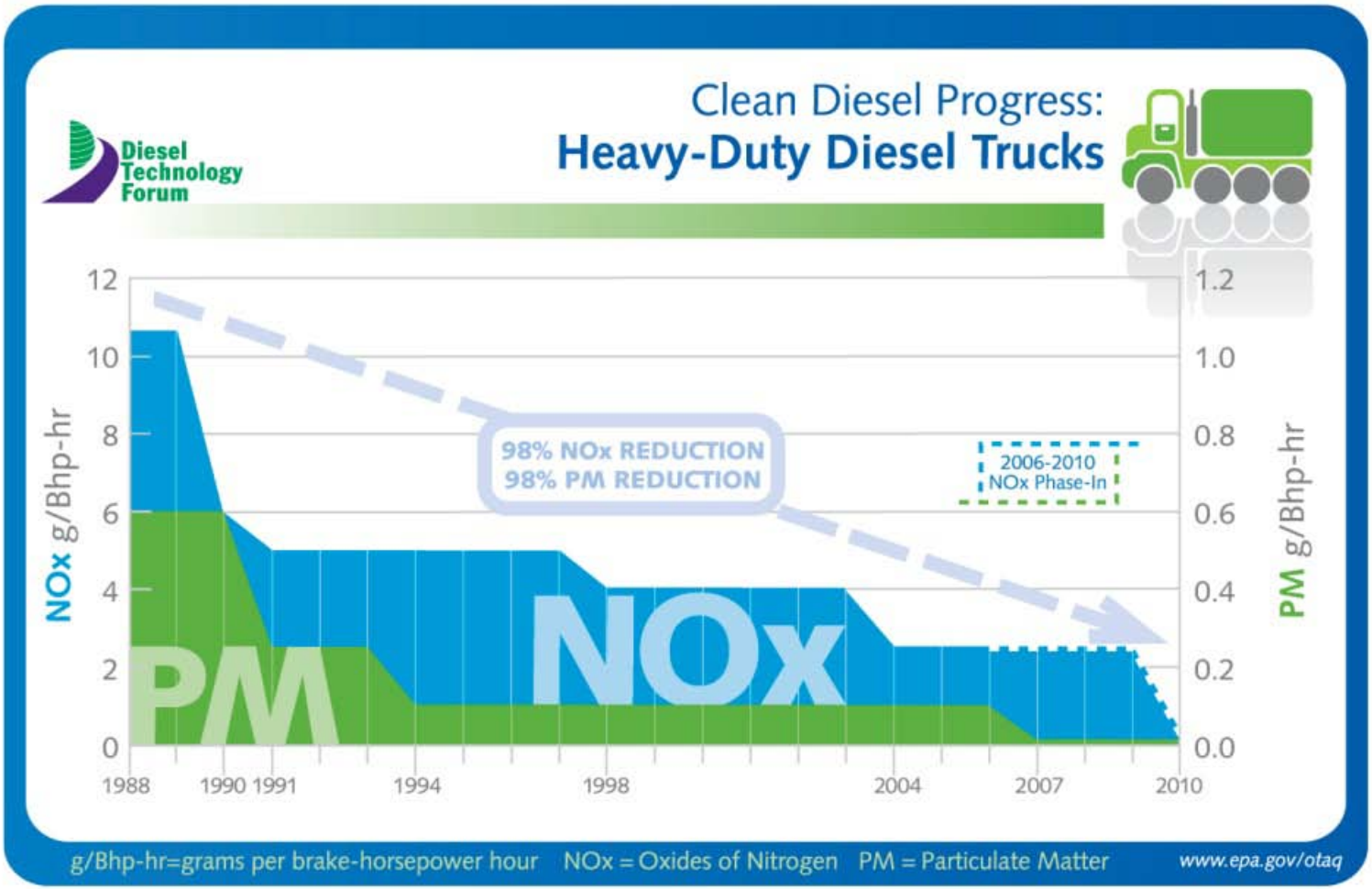
- **Class 8 trucks** use 80% of all commercial trucking industry fuel – 28% of all fuel usage.

  From 1970-2007 the number of trucks more than doubled while mileage increased 3.9%.
- Heavy-duty trucks transport more than 70% of all U.S. goods purchased.
- 80% of communities are served exclusively by truck.

DIESEL IS (STILL !) THE PRIME FREIGHT MOVER FOR THE FUTURE BECAUSE . . .

- **Energy Density –** more BTU's/gal
- **Energy efficient** -- higher thermal efficiency of engine
- **Power output –** high torque necessary to move heavy loads at speed
- **Durability and reliability**
- **Fuel handling characteristics** – less flammable than gasoline, less explosive characteristics than gaseous fuels
- **Fuel flexibility** – renewable fuel-ready, GTL, etc.
- **Availability**- maintenance and fueling infrastructure
- **Environmental Performance** -- near zero emissions

… AND MAKING DIESEL CLEAN ASSURES KEY ROLE IN THE FUTURE



CLEAN DIESEL POWER ENABLES SUSTAINABLE GOODS MOVEMENT

Expanded use of Hybrid powertrains coupled to clean diesel engines on renewable fuels

Diesel engine operating on increasing blends of biodiesel and renewable fuels

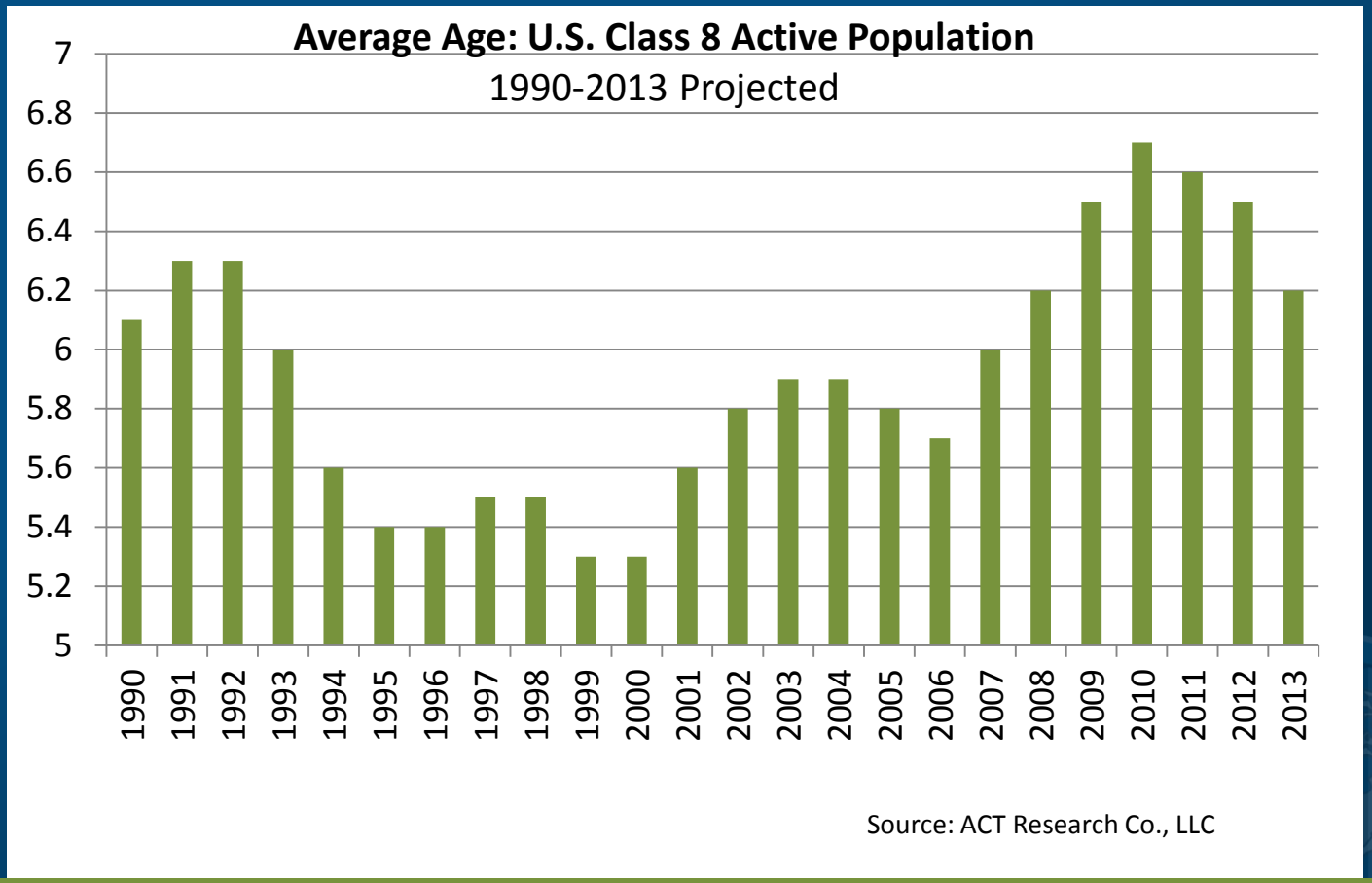
Further continuous improvement to optimize emissions and efficiency strategies *(EPA/NHTSA GHG Rules, DOE SuperTruck)*

Clean diesel baseline 2010

Where we are, what can be done

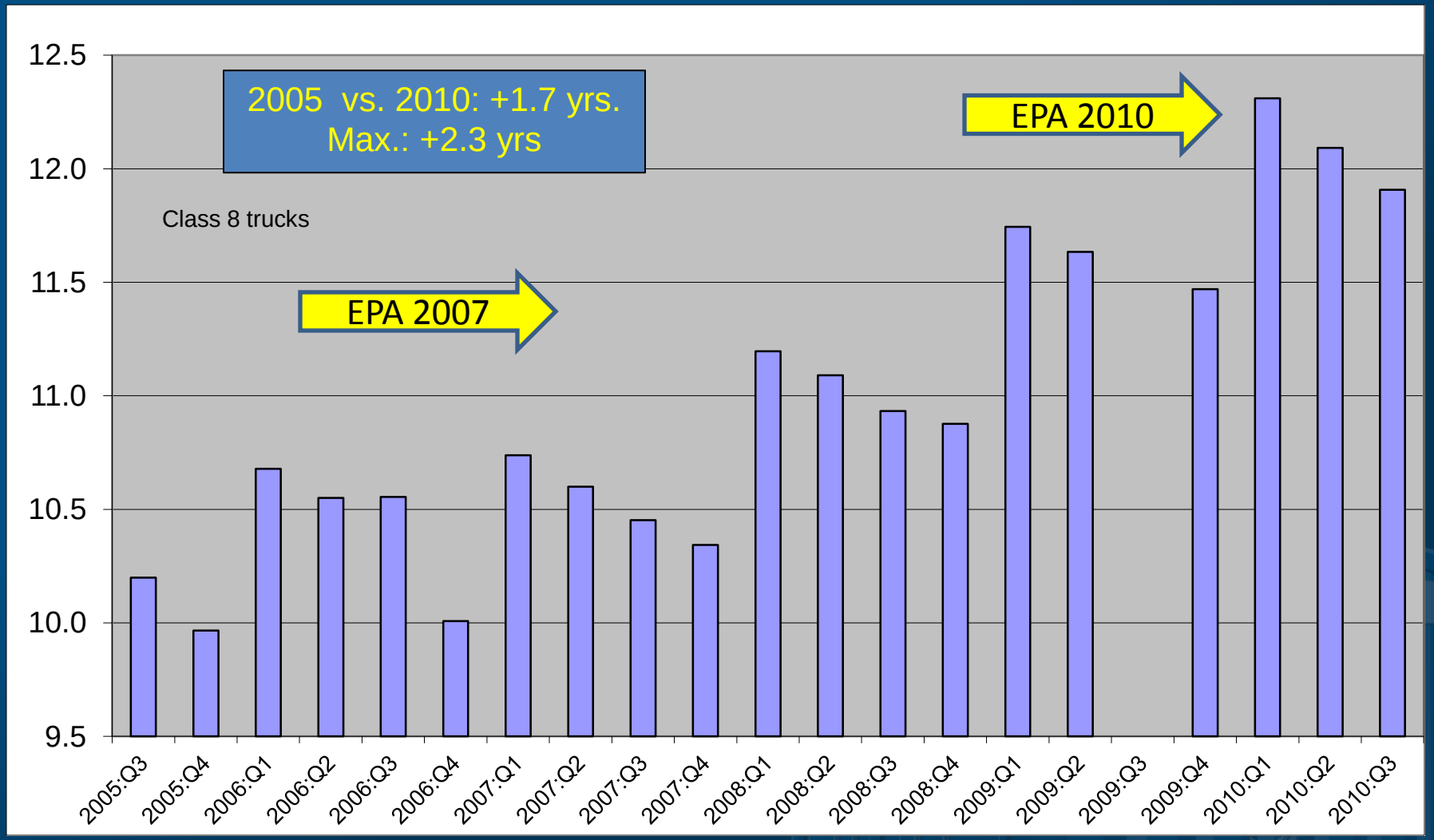
ADOPTING NEW TECHNOLOGIES

NEW TECHNOLOGY ACQUISITION IMPACTED BY ECONOMY, FREIGHT DEMAND, CONFIDENCE ETC.



Older trucks = Higher fuel consumption & Higher Emissions

Uncertain on new emissions Technology, gloomy economic signals, all have had a negative influence on acquiring new technology



FLEET TURNOVER VARIES BY CARRIER TYPE AND TRUCK TYPE

VEHICLES IN OPERATION: U.S.
AS OF SEPTEMBER 2010, 8.5K GVWR THRU CLASS 8

REGISTRATION CARRIER TYPE	EPA/NHTSA CATEGORY AVERAGE AGE		
	HD PICKUP/VAN	VOCATIONAL	TRACTOR
INDIVIDUAL	10.1	18.4	15.4
FOR HIRE	8.2	11.0	9.1
PRIVATE	8.7	13.0	12.7
LEASE	6.6	7.7	6.4
GOV'T	7.3	10.2	12.0
UTILITIES/COMM.	7.9	9.9	10.6

WHAT DRIVES TRUCK BUYERS TO BUY?

Fuel Economy

- **Largest variable cost of operation**

Weight

- **More freight, enhanced revenue**

Price

- **Must make good business sense**
- **Alternative: Older, less environmentally-friendly, less fuel efficient equipment**

ACCELERATING ADOPTION OF NEW TECHNOLOGIES: *2010 CLEAN DIESEL ENGINES*

- The new Truck and Clean Diesel Engine *(2010 generation)* technology performance is real and economically compelling to fleets
  - 2010, 2011 trucks get 5-6% better fuel economy
  - At $4.00 gallon fuel prices, this is real money!
- **Fleets have confidence in the new technology**
  - New Truck Sales are growing – up 46 % Oct 2011 vs. 2010

New Generation Diesel Engines Deliver greater Fuel efficiency in long haul trucking

Typical Long Haul …

46,000	Payload (lbs)
23	Payload (tons)
150,000	Miles/year
6.0	Miles/gallon
0.26	Gallons/ton/mile
25,000	Gallons/truck/year
$100,000	Fuel cost per year *

2011 clean diesel engine …

+5%	Improved fuel efficiency
1250	Gallons saved/year
14	Fewer tons CO_2 year
$5000	Fuel savings per year *

** Assumes $4/gallon*

Courtesy– Cummins, Inc.

POWERTRAIN TECHNOLOGIES FOR REDUCING FUEL 2015-2020 *(NEW NAS REPORT FINDINGS)*

TABLE S-1 Range of Fuel Consumption Reduction Potential, 2015-2020, for Power Train Technologies

Technology	Fuel Consumption Reduction (%)
Diesel engines	15 to 21
Gasoline engines	Up to 24
Diesel over gasoline engines	6 to 24
Improved transmissions	4 to 8
Hybrid power trains	5 to 50

Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles
http://www.nap.edu/catalog/12845.html

VEHICLE TECHNOLOGIES FUEL REDUCTION POTENTIAL 2015-2020 *(NAS REPORT FINDINGS)*

TABLE S-2 Range of Fuel Consumption Reduction Potential, 2015-2020, for Vehicle Technologies

Technology	Fuel Consumption Reduction (%)
Aerodynamics	3 to 15
Auxiliary loads	1 to 2.5
Rolling resistance	4.5 to 9
Mass (weight) reduction	2 to 5
Idle reduction	5 to 9
Intelligent vehicle	8 to 15

Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles
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UPGRADING THE OLD VS. ACQUIRING THE NEW

- Modernizing and upgrading existing vehicles likely to remain critical consideration given economic conditions
  - Initially to addresses emissions performance – no advantage to carriers
  - Fuel savings (idle reduction, tire improvements, etc) provide fuel savings benefits
- Acquisition of new technology
  - Economic recovery
  - Confidence, Credit, Competition

WHAT WE KNOW WORKS . .

- *Outreach and education positively influence change; small investments help yield big returns*
  - National Clean Diesel Campaign
  - SmartWay Partnership
    - Awareness of saving fuel
    - Making analysis tools more accessible
- Shared government industry partnerships drive faster development and introduction of cleaner fuel efficient technology
  - US DOE 21st Century Truck, and SuperTruck

CHARACTERISTICS AFFECTING ADOPTION OF NEW TECHNOLOGIES

Encourage

1. Relative advantage
2. Compatibility with past usage
3. Simplicity of use
4. Observability
5. Trialability
6. Divisibility

Discourage

1. Value barrier
2. Usage barrier
3. Complexity
4. Risk barrier

Source: Bloomsburg University of Pennsylvania ;

From North American Council on Freight Efficiency

NEW TECHNOLOGY ACQUISITION

- **Financial barriers – Incentivizing the incremental costs of new technology**
  - Accelerated depreciation *(ends 12/31/2011)*
  - Does a 12 % Federal Excise Tax impact acquisition of new technology?
    - *Legislation introduced Rep's Gerlach, Blumenauer);*
- *Provide Operational advantages*
- *Provide Productivity advantages*

Summary

- **Diesel remains the mainstream goods movement technology;**
- **Today's Clean Diesel trucks**
  - are near zero emissions;
  - are achieving 5-6% increases in fuel economy
- **Tomorrow's New Clean Diesel trucks …will do better**.
- **Opportunities exist to accelerate adoption of new technologies – education, policy tools, market forces**

THANK YOU

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